



Goddard View

Volume 10 Issue 4
April 2014

MMS
MAGNETOSPHERIC MULTISCALE MISSION

The Magnetospheric Multiscale Mission (MMS)

MMS is a Solar Terrestrial Probes (STP) mission within NASA's Heliophysics Division. The MMS mission, consisting of four identically instrumented spacecraft, will use Earth's magnetosphere as a laboratory to study magnetic reconnection. As the spacecraft move through the dayside and nightside magnetosphere, they will observe the reconnection process in three dimensions, allowing them to capture the three-dimensional structure of the reconnection sites they encounter.



Four MMS spacecraft will be launched, integrated, and tested together. They will be launched on an Atlas V rocket from Cape Canaveral, Florida. For more information visit www.nasa.gov/mms



GoddardView

THE WEEKLY



Kind of a Big Deal

NASA Goddard's [social media](#) team won a Shorty Award in the "social media's best government" category. NASA Goddard took the prize at the Shorties' sixth annual ceremony in New York City on April 7. The [Shorty Award](#) honors the best uses of social media across sites such as Twitter, Facebook, Tumblr, YouTube, Foursquare and others.

Make a #GlobalSelfie with NASA

NASA invites everyone to celebrate Earth Day with the #GlobalSelfie event. Once pictures stream around the world on Earth Day, the individual pictures will be used to create a mosaic image of Earth—a new "Blue Marble" built with your photos. Click the image to participate.



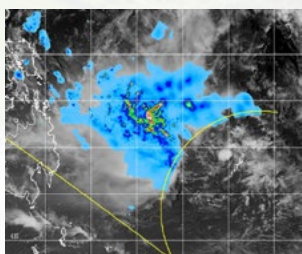
Construction to Begin on Asteroid-Bound Spacecraft

NASA's team to conduct the first U.S. mission to collect samples from an asteroid received the go-ahead to begin building the spacecraft, flight instruments and ground system, and launch facilities. OSIRIS-REx is scheduled to rendezvous with the asteroid Bennu in 2018. Learn more by clicking on the image.



TRMM Catches Peipah's Dying Breath

Tropical depression Peipah showed some last-life signs of strength with areas of heavy rainfall on April 10 as it was dissipating in the Pacific Ocean. TRMM passed over Peipah and caught its "dying breath" of a burst of heavy rain as it encountered adverse environmental conditions. Click on the image to see more.



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On the cover: Children make paper MMS spacecraft models while attending the Greenbelt Mini Maker Faire on April 5, 2014. The fair is an outdoor show and tell event. NASA Goddard's Craig Tooley, project manager for the Magnetospheric Multiscale mission, along with education specialists Troy Cline and Carolyn Ng, were on hand to share the mission of MMS. Photo Credit: NASA/Troy Cline

GoddardView Info

Goddard View is an official publication of NASA's Goddard Space Flight Center. Goddard View showcases people and achievements in the Goddard community that support Goddard's mission to explore, discover and understand our dynamic universe. [Goddard View](#) is published by Goddard's Office of Communications.

You may submit contributions to the editor at john.m.putman@nasa.gov. Ideas for new stories are welcome but will be published as space allows. All submissions are subject to editing.

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GODDARD SCIENTIST RECEIVES VEGA MEDAL FROM KING OF SWEDEN

By: Talya H. Lerner

NASA's Goddard Space Flight Center in Greenbelt, Md., is home to hundreds of dedicated scientists, engineers and project support staff. At Goddard, some of the most cutting-edge Earth science innovation and research takes place, and some of that innovation has earned a Goddard scientist the 2014 Vega Medal.

The Swedish Society for Anthropology and Geography awards the Vega Medal every three years to a person who has shown excellence in the fields of physical geography, exploration or archaeology. Climate scientist Compton Tucker received the award for his contributions to remote sensing, the study of Earth using satellite data.

Tucker has studied plant life on Earth for the past 33 years, including photosynthesis, global agricultural production, land cover, tropical deforestation and the prediction of disease outbreaks connected to changes in climate. His work is also used for famine early warning and desert locust control.

Tucker has worked with global satellite data from NASA and NOAA, the National Oceanic and Atmospheric Association, to measure photosynthesis from space. Before Tucker and his coworkers started daily observations of land vegetation in 1981, no one had measured global land photosynthesis from space over time. A few years earlier, Tucker worked with NOAA to reconfigure their instruments that made space-based study of photosynthesis possible in the first place.

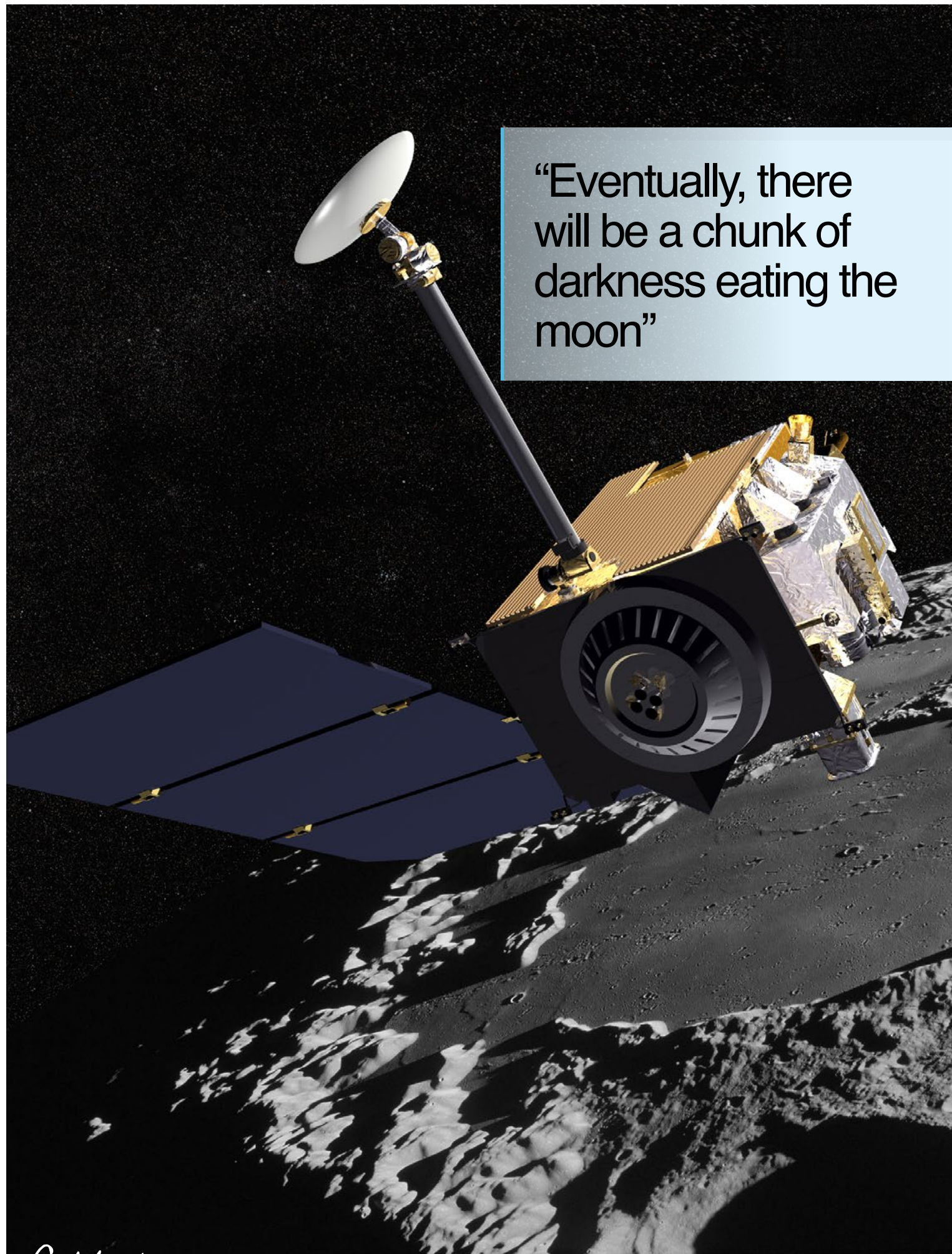
The work of Tucker's team has led to a 33-years-and-counting data set that is invaluable for scientists studying Earth's climate.

"The consistent and well-defined observations that can only be done by orbiting satellites have provided us with a unique understanding of the interaction and changes happening among the air, land and water systems here on Earth," said Tucker. "Over the last 30-plus years, we have observed how well plants are converting light energy to chemical energy, especially at higher northern latitudes, where cold temperatures limit plant growth. We have also seen how the growing season is starting earlier and lasting longer. Only through three decades of data from Earth-viewing satellites do we have this record of global vegetation through time."

"I thought the email notifying me of the award was a prank," Tucker said. "I'm very happy about the Vega Medal because of all the NASA Goddard people who make possible Earth science satellite data and its use. My coworkers and I are at the end of a long line of dedicated NASA civil servants and contract employees who make our work possible." Carl XVI Gustaf, the king of Sweden, gave Tucker the award on April 14 at the Royal Castle in Stockholm, Sweden.

Tucker has received other awards for his satellite studies of Earth. These include the Henry Shaw Medal from the Missouri Botanical Garden, NASA's Exceptional Research Medal, the National Air and Space Museum Trophy, the NASA-U.S. Geological Survey Pecora Award, the Galathea Medal from the Royal Danish Geographical Society, and the Mongolian Medal of Friendship. ■

Climate scientist Compton Tucker (right) receives a Vega Medal from Carl XVI Gustaf, the king of Sweden on April 14, 2014. Photo provided by Compton Tucker



“Eventually, there will be a chunk of darkness eating the moon”

LRO MISSION AND NORTH AMERICA TO EXPERIENCE TOTAL LUNAR ECLIPSE

By: Claire Saravia

When people in North America look up at the sky in the early morning hours of April 15, they can expect the moon to look a little different.

A total lunar eclipse is expected at this time, a phenomenon that occurs when the Earth, moon and sun are in perfect alignment, blanketing the moon in the Earth's shadow.

Although lunar eclipses happen multiple times in a year during a full moon, this eclipse will be a particularly unusual viewing opportunity for North America. Because Earth's Western Hemisphere will be facing the moon during the eclipse, the continent will be in prime position to view it from start to finish. In addition, the eclipse will coincide with nighttime in North America. The entire continent won't be able to witness a full lunar eclipse in its entirety again until 2019.

“Sometimes they'll happen and you'll have to be somewhere else on Earth to see them,” said Noah Petro, [Lunar Reconnaissance Orbiter](#) deputy project scientist at NASA's Goddard Space Flight Center in Greenbelt, Md. “Most [residents] of the continental United States will be able to see the whole thing.”

For those who are awake to watch the eclipse, which is scheduled to begin around 2:00 a.m. EDT and last over three hours, Petro said there would be several changes people can witness. When the moon first enters Earth's partial shadow, known as the penumbra, a dark shadow will begin creeping across the moon. This will give the illusion that the moon is changing phases in a matter of minutes instead of weeks.

“Eventually there will be a chunk of darkness eating the moon,” Petro said.

At the eclipse's peak, around 3:45 a.m. EDT, the moon will enter Earth's full shadow, the umbra. At this stage, Earth's atmosphere will scatter the sun's red visible light, the same process that turns the sky red at sunset. As a result, the red light will reflect off the moon's surface, casting a reddish rust hue over it.

“It's a projection of all Earth's sunsets and sunrises onto the moon,” Petro said. “It's a very subtle effect, and if any part of the moon is illuminated in the sun, you can't really see it.”

Although lunar eclipses are fairly common, Petro said they don't happen every month. Because the moon's orbit is tilted, it doesn't pass through Earth's shadow each time it orbits

the planet. This is the same reason why solar eclipses—which occur when Earth passes through the moon's shadow—don't occur monthly.

Petro said lunar eclipses are a special treat people should take the opportunity to watch, even if it is at a late hour.

“They don't happen all the time, and the sky has to be clear,” Petro said. “It really gives you a chance to look at the moon changing.”

In addition to being a spectacle for North America residents, Petro said NASA's Lunar Reconnaissance Orbiter team would be paying particular attention to this eclipse. The LRO mission, which is currently orbiting the moon, will be plunged into darkness for an extended period during the eclipse. Because the spacecraft's batteries need sunlight to charge, it will be forced to run without recharging longer than usual.

“The spacecraft will be going straight from the moon's shadow to the Earth's shadow while it orbits during the eclipse,” Petro said.

While this isn't the first time LRO has orbited the moon during an eclipse, its past orbits have allowed it to pass into Earth's shadow only for a short period. This time, the spacecraft will have to pass through the complete shadow twice before the eclipse ends. However, Petro said the team expects the spacecraft to make it through the eclipse without a hitch.

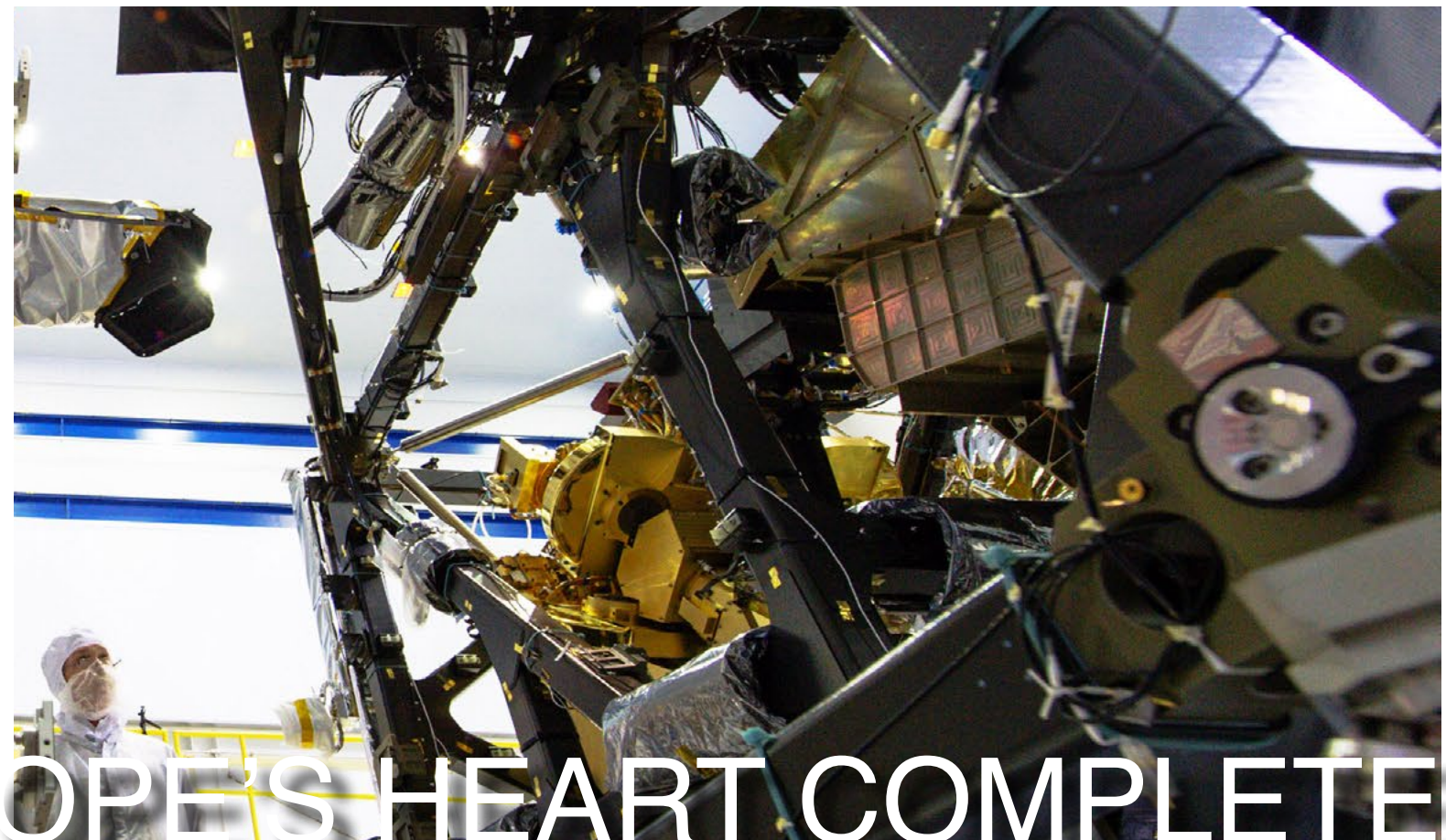
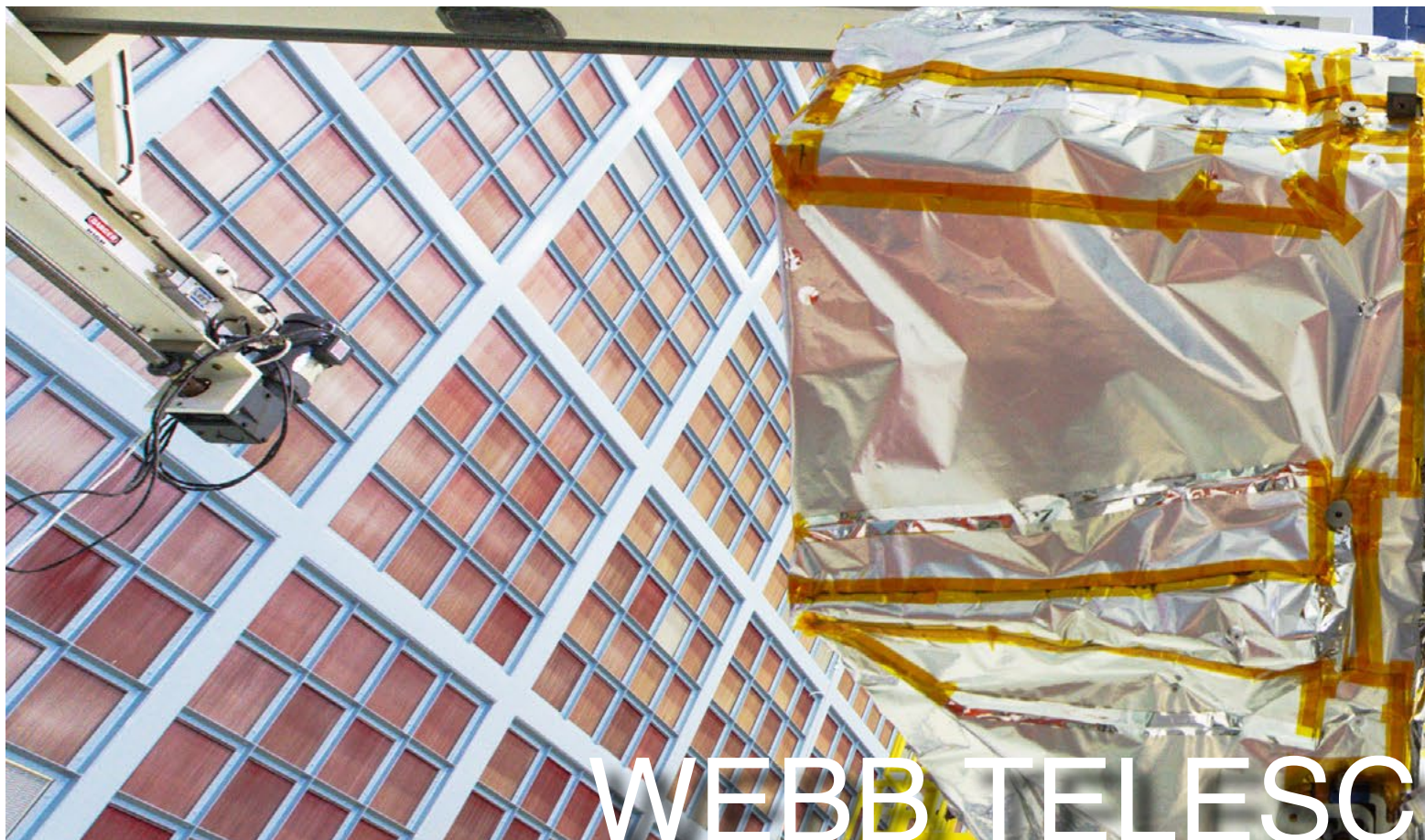
“We're taking precautions to make sure everything is fine,” Petro said. “We're turning off the instruments and will monitor the spacecraft every few hours when it's visible from Earth.”

Although LRO would be forced to shut down its instruments for this eclipse, Petro said other lunar eclipses are a great opportunity for the mission to study how the lunar surface cools during these events, giving insight into the materials making up the surface.

While people watch the moon change in the sky April 15, the LRO team will be ready.

“For quite a while, people in LRO have been analyzing what's going to happen during this eclipse,” Petro said. “We'll make sure the world knows LRO survived with no problems.” ■

Opposite: Artist concept of the Lunar Reconnaissance Orbiter with Apollo mission imagery of the moon in the background. Image credit: NASA



WEBB TELESCOPE'S HEART COMPLETE

By: Laura Betz

The last piece of the James Webb Space Telescope's heart was installed inside the world's largest clean room at NASA's Goddard Space Flight Center in Greenbelt, Md.

What looked like a massive black frame covered with wires and aluminum foil, the heart or Integrated Science Instrument Module now contains all four of Webb's science instruments. Together, these instruments will help unlock the history of our universe, from the first luminous glows after the Big Bang, to the formation of stellar systems capable of supporting life on planets like Earth, to the evolution of our own solar system.

Teams of engineers recently navigated very cramped spaces with delicate materials and finished surgically implanting the last of the four instruments that will fly on the Webb telescope—the Near-Infrared Spectrograph, or NIRSpec.

Weighing about as much as an upright piano (about 430 pounds), the NIRSpec was suspended from a moveable counterweight called the Horizontal Integration Tool, or HIT. From below, the engineering team was tasked with painstakingly moving this vital instrument to its final position inside the large black composite frame, officially called the Integrated Science Instrument Module.

As the team maneuvered this crucial instrument through very tight, hard to reach spaces inside the Webb telescope's heart, they ensured there was no unintentional contact with the frame because the instrument's materials are very stiff but brittle. Disturbing any of those materials could have caused major setbacks that could damage NIRSpec.

"Part of the challenge is that this instrument cannot be installed in a straight linear move. In order to avoid interference with already installed systems, the instrument will have to follow a special pattern kind of like a dance," said Maurice te Plate, the European Space Agency's [Webb](#) system integration and test manager at Goddard. "During the crucial phases of the installation, the room is kept very silent because whenever there is a potential issue one of the engineers must hold the process until everything is checked out so they can proceed."

Engineers needed NIRSpec's six individual feet or legs to align with six designated "saddle" points on the ISIM within the width of a little more than that of a human hair. To hit their marks, these engineers had rehearsed these complicated movements, performing simulations and precise calculations on both sides of the ocean.

As they moved the instrument into position they also slowly transferred its weight off of the HIT to bolt it into place. Securing NIRSpec inside the heart was a major mission milestone, and was the first real physical contact between

NIRSpec and the ISIM. Teams from ESA, NASA, and Airbus Defence and Space, in Ottobrunn, Germany, have been working on this instrument for more than 10 years. "NIRSpec is a multi-object spectrograph, which means it will be capable of observing 100 objects in the cosmos simultaneously. For each of these objects the captured light will be unraveled into a spectrum," te Plate said.

By sending light from each distant object through an optical device like a prism, NIRSpec reveals the light in all its colors.

"Each type of atom or molecule that the object is composed of leaves a unique imprint on its spectrum in the form of spectral lines. These lines are like unique fingerprints for that particular atom or molecule," said te Plate.

From a spectrum, scientists can obtain a wealth of information about a distant object, like its chemical composition, mass, distance, velocity and temperature.

NIRSpec was provided by the European Space Agency and built by Airbus Defence and Space in Germany. Goddard developed the Focal Plane Assembly and the crucial Micro Shutter Array, which allows the object selection.

This accomplishment comes right after engineers finished installing another essential part of the Webb- the Near Infrared Camera into the center of the heart of the telescope.

NIRCam is a unique machine because in addition to being one of the four science instruments on the Webb, it also serves as the wavefront sensor, which means it will provide vital information for shaping the telescope mirrors and aligning its optics so that they can function properly and see into the distant universe. The NIRCam instrument will operate at very cold temperatures, and will be tested to ensure that it will be able to withstand the environment of space.

The NIRCam is Webb's primary imager that will cover the infrared wavelength range 0.6 to 5 microns. It will detect light from the earliest stars and galaxies in the process of formation, the population of stars in nearby galaxies, as well as young stars and exoplanets in the Milky Way. NIRCam is provided by the University of Arizona and Lockheed Martin Advanced Technology Center.

Webb is an international project led by NASA with its partners the European Space Agency and the Canadian Space Agency.

The James Webb Space Telescope is the successor to NASA's Hubble Space Telescope. It will be the most powerful space telescope ever built. ■

Above: Engineers install NIRSpec in the heart of Webb. Photo credit: NASA/Goddard/Chris Gunn



Carla Matusow

Position: Code 586,
JPSS GRAVITE
Manager

Before Goddard: I worked at Goddard for 10 years and left to stay home with my children. Later, I worked part-time on a wide variety of freelance projects including hospital software and school management systems. Now, I'm very happy to return to Goddard.

Other: I live in Wheaton, MD with my husband, David, who also works at NASA (on JWST), and with my two children.

Lisa Cropper Johnson

Position: 120/Equal Employment Opportunity Specialist managing and implementing EEO activities and programs.

Before Goddard: University of Maryland Eastern Shore. Previously employed at Wallops as the EO Programs Manager from 2000-2004 and in the Human Capitol Office from 1988-1999.

Interests: Listening to music, writing, bowling



Why Goddard? Returning to Wallops is an exciting opportunity to assist in shifting the organizational culture toward equal opportunity, affirmative employment, appreciating diversity and ensuring inclusion.

Other: Married to Timothy Johnson for over 25 years. We have two children, Timothy, Jr., and Timisa, both are students at University of Maryland, College Park.

Cheryl A. Lunt

Position: Code 210/
Contract Specialist

Before Goddard: Contract specialist at NASA's Stennis Space Center

Interests: Horseback riding, surfing and spending time with friends and family.

Previous employer: PFC

Why Goddard? A new challenge



Zbigniew Moore

Position: Code 803/Aerospace Engineer

Before Goddard: Contractor for Orbital

Interests: Fishing

Why Goddard? Be a part of new and exciting challenges within NASA.

Other: Wife Kim, son James.



EMPLOYEE SPOTLIGHT



You never know what treasure you'll find in Istanbul's Grand Bazaar. The same is true of the Goddard Employee Welfare Association's spring craft fair in the Building 8 auditorium.

On April 2, 2014, depending on which side of the table they stood, Goddard employees brought their wallets and their talents to the GEWA spring craft fair. The craft fair, held biannually in the spring and fall, is an opportunity for vendors—who are either Goddard employees or sponsored by one—to offer items they made or sourced themselves.

Employees explored tables filled with a variety of items, ranging from evening bags repurposed from pieces of antique Persian rugs to beeswax soaps and lotions made from wax from the vendor's own bees.

The craft fair is an extension of the Goddard family. Returning vendor Shahla Abdi, the daughter of long-time Goddard employee Sharon Garrison, sold her handmade jewelry pieces. Abdi designs her unique pieces to showcase materials from all over the world, including antique silver pieces from Nepal, West African coin metal and Indian wound glass fashioned into exotic combinations and designs.

"You can't just walk into Michael's and buy some of these beads," Abdi said. "It's been really exciting watching people I don't know get into the aesthetic [of the pieces]."

Abdi especially enjoys coming to Goddard because of the curious customers, who are always asking questions about the origins, age and design of the pieces.

"Goddard is a great group of people," Abdi said. "I was really surprised by how many people here are into my items."

All year long, Melanie Scofield is focused on her job as safety manager for the Applied Engineering and Technology Directorate, but on craft fair day she transforms into Creations by Melanie, purveyor of fine, handmade jewelry. Scofield, who has had a table at the craft fair for the past four years, welcomes the opportunity to chat with her colleagues while selling her pieces.

"It's a nice, safe environment here at Goddard," Scofield said. "I think [the fair] brings more of a sense of community here."

While the fair allows employees to take a break from work to do some light shopping, it also generates business for some entrepreneurs looking to share their unique creations, and their curiosity, with the rest of the center. ■

Photo credit: NASA/Goddard/Debora McCallum.

GODDARD'S GRAND BAZAAR: THE SPRING CRAFT FAIR

By: Claire Saravia and Elizabeth M. Jarrell

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ASTRONAUT VISIT

Photo credit: NASA/Goddard/Debora McCallum



On Wednesday, March 26, NASA astronaut Karen Nyberg and ESA astronaut Luca Parmitano shared their extraordinary spaceflight experiences with the Goddard community. The astronauts presented their experiences, participated in a question and answer session and then signed autographs afterward.

Astronauts [Nyberg](#) and [Parmitano](#) traveled to the International Space Station on May 28, 2013 aboard the Soyuz TMA-09M spacecraft from Kazakhstan. They spent a total of 166 days in space by the time the flight engineers landed safely in Kazakhstan on November 10, 2013.



While onboard the International Space Station during [Expedition 36](#), the astronauts took advantage of the space station's unique micro-gravity environment to expand the scope of research conducted. They performed experiments that covered technology development, physical sciences, human research, biology, biotechnology and Earth observations. During [Expedition 37](#), the crew conducted a variety of research with several new investigations focused on human health and human physiology. They also performed experiments that covered technology demonstration, Earth and space science, biology and biotechnology.

Catch up with Nyberg and Parmitano on Twitter: [@AstroKarenN](#) and [@astro_luca](#). ■



I, TORMENTUM

By: Elizabeth M. Jarrell

Isaac Asimov's Three Laws of Robotics and Zeroth Law from his 1950 novel "I, Robot" concern helping humans and not hurting them, but they do not cover robots playing basketball. To Megan Meehan, instrument systems engineer for the Advanced Topographical Laser Altimeter System at NASA Goddard, robots are all about "coopertition:" a cooperative robotic competition under the honor system.

Meehan has her own three laws of robotic competition: "You do your best, you do so honestly and you help your competitors do the same," said Meehan. In this year's competition, the robots will play a modified game of basketball.

Meehan is a technical mentor to a team of high school students who built a competition robot—named "Tormentum"—to compete in the For Inspiring and Recognizing Science and Technology national robotics competition. Since early January 2014, she has devoted almost every free moment to helping the Space RAIDERS/Team 2537 from Atholton High School in Columbia, Md. The team has 70 kids and 20 mentors.

"I don't have kids for right now," said Meehan. "I just borrow other people's kids."

She has the technical expertise, having concentrated on space systems and robotics in college and for her master's degree. She also has the heart. Since high school, she has been deeply involved in volunteer work for the Challenger Learning Centers of the Challenger Center for Space Science Education, a non-profit educational organization founded by families of the crew of the space shuttle Challenger.

"Robots are interesting because you can build something that can accomplish a task," said Meehan. "What's really cool is when you're able to apply the principles of robotics to accomplish tasks that are helpful to people, such as a robotic personal assistant to someone with disabilities."

The first Saturday of January, FIRST issues a challenge to high school students to build a robot able to accomplish specific tasks. Drawing elements from soccer and basketball, two teams of robots with three robots on each team were required to work together to move an exercise ball 24 inches in diameter across a 54-foot field and then toss the ball through a square goal to score. Each game lasted only 2 1/2 minutes.

The kicker: Students only had six weeks to build their robot. "Bag day," the day the rules state that all work must stop, was February 18.

Thanks to their fundraising efforts, Team 2537 had sufficient funds to build a backup robot. From bag day to the actual competition, the drivers practiced test runs with the backup robot. Twenty-four hours before the competition, students were permitted to make last-minute adjustments to the competition robot based on what they learned during testing of the backup robot. In the case of 2537, this meant tweaks to several pieces of hardware and software.



On competition weekend, March 28-30, fifty teams gathered for the Washington, D.C. regional competition at the Patriot Center at George Mason University in Fairfax, Va. Each team played ten, randomly determined matches. The initial team rankings were announced at noon on Saturday, March 29. Team 2537 was in the middle of the pack.

The top eight teams then each picked two other teams from the other teams to form an alliance of one, three-robot team. The sixth-ranked team picked Team 2537 for their alliance. That's when things got really exciting. Each alliance played the best out of three games.

"We swept our first two rounds and got into the event finals. We got silver medals for second place, our team's best finish ever. We narrowly missed the opportunity to head to the FIRST Championship. The finals were a clean, hard-fought match for both our opponents and fellow alliance members, and I couldn't be more proud of all involved" said Meehan.

Thanks again to their fundraising efforts, Team 2537 was able to compete at a second regional, the Chesapeake regional, on April 4-6, 2014 at the University of Maryland.

"Robotics get me excited about engineering. The pure problem-solving aspect is the fun part. The students built their robots using good, old-fashioned garage experimentation. We got the kids to love the tinkering, the experimentation and the coopertition," said Meehan. ■

Center: Megan Meehan and Fernando Pellerano next to Tormentum. Photo credit: NASA/Goddard/Bill Hrybyk